Training Plan

Checkout and Launch Control System (CLCS)

84K00060

Approval:

Retha Hart, NASA CLCS Project Manager	Date	Ralph Esposito, USA CLCS Project Manager	Date
Tom Fleming, NASA CLCS Project Controls	Date	David L. Hosley, USA Director, Technical Training	Date
	Date		Date

PREPARED BY: ray.g.Wollett@usago.ksc.nasa.gov

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PREFACE

The “Checkout and Launch Control System (CLCS) Training Plan” was prepared by the United Space Alliance (USA) Space Flight Operations Contract (SFOC) Technical Training Directorate, Hardware and Software Division, in conjunction with the USA Ground Operations Division and the NASA CLCS Project Office.

The primary responsibility is with USA SFOC Technical Training Directorate 61-90.

Questions concerning the content of this document should be directed to Ray Wollett, (407)861-0341, USK-155, or ray.g.Wollett@usago.ksc.nasa.gov

TRAINING PLAN

CHECKOUT AND LAUNCH CONTROL SYSTEMS (CLCS)

1. INTRODUCTION

1.1 PURPOSE

The “Checkout and Launch Control System (CLCS) Training Plan” defines and describes the training and training related requirements for the CLCS, which is the replacement system for the Space Shuttle Launch Processing System (LPS) and the foundation system for future launch and control systems. This plan identifies the classifications of personnel needing training under this plan, the skills and subjects they are to learn, the methods of instruction to be used, and the general locations and dates of instruction.

1.2 SCOPE

This plan addresses the training needs of the CLCS development team and the Space Transportation System (STS) processing community in converting to the CLCS. It will list relevant courses, as they are determined, to be conducted by SFOC Technical Training, contract training, university and college resources, and other sources and methods of instruction.

1.3 AUTHORITY

The “Checkout and Launch Control System (CLCS) Training Plan” is a contract required document. It is produced under the authority and in accordance with the Program Provisioning Change Order (PPCO) #14 of the Specialty Engineering Path 3.2.2.3, which requires the creation of a plan for the training of personnel who will be involved with the creation and implementation of the CLCS.

1.4 PLAN PHILOSOPHY AND DESCRIPTION

1.4.1 Philosophy

The CLCS is an evolving system that will use the “build a little, test a little” philosophy. Deliveries are scheduled at six month intervals over a period of several years. In keeping with the developmental nature of CLCS, this plan focuses on the unique needs of the individual deliveries, while being mindful of the overall scope of the project. Revisions and additions to the plan will be conducted on an as needed basis to best meet the training needs of the CLCS project and the Space Shuttle program.

Development and presentation of courses will be timed to coincide with the successive deliveries and their specific training needs. As more complex and more complete systems are created, the

relevant courses will be modified to include the emerging information. If the delivery schedule is changed, the training schedule will be amended accordingly to increase the effectiveness of the training by having it occur as close to the date of its application as possible.

A key factor in the execution of this plan will be the availability of CLCS hardware, software, and simulators for training purposes.

When on-the-job-training (OJT) is the selected mode of instruction, it will be task specific and accomplished primarily by the CLCS developers, designated instructors, or others who have become competent (e.g., certified, standboarded) to do that task.

The various types of hands-on and classroom training will be directed to the following needs:

- CLCS system orientation, familiarization, and operation.
- Cross training for console users and sustaining engineering users where needed.
- New technology and data handling differences, with a focus on differences to the CCMS.
- Recurring requirements and follow-on training to support subsequent CLCS delivery cycles and continued operation.

1.4.2 Plan Overview

The CLCS training plan contains four major sections, which are as follows:

- Section 1, Introduction, describes the overall organization of the CLCS training plan.
- Section 2, CLCS Major Delivery Milestones, reviews the CLCS major deliveries and their relation to the training effort.
- Section 3, CLCS Training Administration, describes the support and certification system included in the training effort.
- Section 4, Training Implementation, describes the responsibilities, facilities, and personnel categories to be trained.

The CLCS training plan also contains five appendices:

- Appendix A, Students Per Course Grouping By Quarter, summarizes training requirements by course group.
- Appendix B, Groupings by Department Matrix, presents detailed training requirements by department for each course group.
- Appendix C, Course Grouping Presentations x Hours Per Grouping, summarizes training requirement hours for each course group.
- Appendix D, Projected Schedule of CLCS Course Groupings, presents a proposed schedule for delivery of CLCS training by course group.
- Appendix E, Glossary and Acronyms, lists in alphabetical order definitions and terms used in this document.

As part of the STS processing effort, the CLCS training described in this plan will merge with the ongoing training and record keeping described in Data Requirements Description (DRD) 1.5.5.4.3.-a, “SFOC Training/Certification Plan and Schedule Report.” Unless specifically waived in this plan, policies and practices delineated in that plan will carry over to this plan. If a conflict

of meaning exists between this and the overall STS processing training plan, the meaning as understood in the overall plan will prevail.

1.5 RELATED DOCUMENTS

"SFOC Training/Certification Plan and Schedule Report," April 24, 1997.

"NLPS Project Baseline Management and Technical Volume," September 16, 1996.

2. CLCS MAJOR DELIVERY MILESTONES

To aid in the scheduling and sequencing of courses, reference the CLCS milestone chart in the latest "Program Management Plan: Checkout and Launch Control System," 84K00050, for delivery date information.

For an updated summary of milestones onthe CLCS Delivery Schedule, refer to web site http://clcs.ksc.nasa.gov/pc/doc/sherikon-proj-sched.pdf.

3. CLCS TRAINING ADMINISTRATION

As part of the STS effort, CLCS training is governed by policies and procedures described in the "SFOC Training/Certification Plan and Schedule Report" and SFOC Standard Processing Instruction (SPI) documents governing training. These SPIs include the following:

LG-701(7)K	Technical Audit of Training Courses
LG-702(7)K	On-the-Job Training (OJT)
LG-704(7)K	Requesting, Scheduling, and Coordinating Training
LG-705(7)K	Designated Instructor (DI) and Test Control Monitor (TCM) Programs
LG-707(7)K	Training Board
LG-708(7)K	Training Certification and Records System (TCRS) Access
LG-709(7)K	Training Records
SP-017(2)K, Book 2	Certification System

3.1 CLCS TRAINING TEAM (CTT)

A team drawn from the various SFOC directorates and NASA will be formed to work the CLCS related training needs. The CTT will consist of representatives from affected directorates and other key persons as needed. CTT tasks are as follows:

1. Accumulate CLCS instructional needs data on which to base decisions as to training needed to support the CLCS effort.
2. Identify and establish new requirements and courses as needed.
3. Determine the most cost effective method of obtaining specific training needs within the constraints of time and resources.
4. Prepare and maintain a listing of CLCS related courses.
5. Identify instructors and Designated Instructors (DIs) to acquire the course content of courses that are to be recurring.
6. Coordinate with the SFOC Technical Training schedulers as courses become available.
7. Assist in assuring all course enrollments are filled and attended.
8. Maintain and update the "Checkout and Launch Control System (CLCS) Training Plan" as needed.

The CTT will be chaired by a representative from the SFOC Training Directorate. It is expected that most of the working of this team will be accomplished through a steering group selected from the CTT members.

3.2 DIRECTORATE CLCS TRAINING POINTS OF CONTACT

CLCS training points of contact are to be established for each of the STS directorates involved with CLCS actions. These people will represent the needs of their respective directorates in the selection, acquisition, and scheduling of CLCS training. The directorate CLCS training points of contact will:

1. Forecast CLCS related training needs for their directorate.
2. Identify personnel to be trained and certified in a timely manner so as to allow time for planning, scheduling, and implementing training for these persons prior to the need date of the information or skills.
3. Participate in identifying and establishing new requirements and courses as needed.
4. Coordinate individual course training requirements with the CTT until this function is passed to the SFOC Technical Training Directorate, or other training functions for the individual courses. During the formative stages of the CLCS project, the CTT will serve a training coordinator function, in addition to its other functions.
5. Ensure employees scheduled for courses attend the courses for which they are scheduled.
6. Arrange alternates for any employee who is unable to attend a scheduled course.
7. Advise the CTT chairperson at the earliest opportunity of any course enrollments that they cannot fill so that alternates might be found in other directorates.
8. Assist in identifying DIs as necessary to increase the instructional capacity of the CLCS effort.

3.3 SFOC TECHNICAL TRAINING SCHEDULING

It is anticipated that many of the instructional needs identified during the progression of the various phases of CLCS delivery will require a quick response on the part of those arranging for and preparing the courses. For this reason, the initial scheduling of CLCS courses will be handled primarily by the requiring departments in concert with the CTT. As courses with a continuing need are identified and when time allows, the CLCS training activities will be integrated into the customary training scheduling processes.

3.4 STANDBOARDING, CERTIFICATION AND RECERTIFICATION

Standboarding, certification and recertification will be established, conducted, and documented in accordance with existing policies.

The initial certification of user readiness to support shuttle processing operations using the CLCS system will be determined based on completion of CLCS orientation and prerequisite training classes followed by an evaluation of user CLCS proficiency during software testing, simulation runs, and on the job evaluation.

The difference between various CLCS user positions and their CCMS equivalents may vary considerably; therefore, no across-the-board process for certifying CLCS engineering readiness is

planned. Certification of an engineer's readiness to use the CLCS will be determined by that engineer's department.

4. CLCS TRAINING IMPLEMENTATION

Most of the people who will work the CLCS are already familiar with the present LPS. The paper system involved with vehicle processing and system maintenance and change is known to them, and the engineers responsible for vehicle processing and the ground support equipment already know their systems. Some of the personnel are already knowledgeable on the languages and software packages which will be used in and with the CLCS.

For this reason, a large portion of the planning for CLCS training will involve identifying what CLCS related subject matter is new to this workforce and assuring this material is learned by those in the workforce needing it. The manner of meeting these needs will depend on the content, numbers of personnel to be trained, time available for preparation and delivery, and available resources.

Certification and training requirements for the various categories of employees transitioning to CLCS already exist for the present system.

To more accurately show required training, the task and subject matrices in the appendices of this plan will be based on the intended student population as described above. Those already trained for the present system will receive the new and delta instruction needed to equip them for comparable functions in the CLCS as outlined in the following description.

Many courses will be independent of previous LPS experience. Attendance at these classes will depend on the possession of their unique prerequisite knowledge and skills.

For classes dealing with the CLCS as a replacement for the LPS, new hire personnel and personnel transferring to an unfamiliar function will need direction from their supervision as to the base knowledge they should have before attending new subject classes and especially when they attend the CLCS/LPS delta classes directed to experienced LPS personnel. The delta classes will assume knowledge of the present LPS system and use it as a springboard to CLCS information. When reasonable, the scheduling of courses should be done through the normal scheduling personnel.

A goal of the CLCS project is to utilize commercial off-the-shelf equipment and programs whenever possible. In keeping with this, training will use commonly available and vendor supplied training whenever it is cost effective or advantageous to do so.

4.1 TRAINING FACILITIES

As schedules and course content permit, CLCS training will utilize primarily the Complex D training building at the Kennedy Space Center (KSC) Launch Complex (LC)-39 area for instruction. Other locations will be used when their use will be of benefit or the Complex D facilities are not available.

Equipment related courses will use the actual equipment whenever possible and appropriate for the course content. Skill with the equipment will involve both scheduled class time and on-the-job experience.

4.2 CURRICULUM ORGANIZATION AND FOCUS

There will be three basic categories of personnel to be trained for the CLCS project: developers, users, and sustaining personnel. Courses will be organized and tailored to meet the diverse needs of these people.

4.2.1 Developer Training

CLCS developer training will take place primarily during the development phase stages of the CLCS project. It is directed to the people who will need the overall understanding of the emerging CLCS systems as well as detailed bodies of information to create those systems in an efficient manner. This training deals with the developer environment, development tools, design and test methodology, and the configuration management system. New technologies will be used for delivery as appropriate within the constraints of time, resources, and course content.

CLCS developer training requires rapid delivery turnaround. Developers need training to implement and deliver system requirements in accordance with CLCS master schedule deadlines. This usually necessitates delivering developer training in the most expeditious means available. In most cases this will mean developer training will be delivered by the equipment vendors or other already available, contract training sources.

When it is anticipated sufficient numbers of people will need a vendor supplied course of instruction, an SFOC Technical Training instructor or DI from the CLCS community will be scheduled to attend the initial presentation(s) of the class and then present subsequent sessions as needed.

4.2.2 User Training

CLCS user training will be prepared for operations, maintenance, sustaining engineering, software developers, and console user personnel.

CLCS user training will teach people how to perform their roles as system operators, console users and set support personnel in the CLCS environment. This level of training will familiarize the user with the new user operational environment resulting from integration of selected Commercial off-the-Shelf (COTS) vendor products. Due to the large numbers of personnel and the extended length of time during which these courses will be presented, their delivery will depend heavily on SFOC Technical Training and DI personnel. Initial cycles of a CLCS unique course will in many cases be delivered by the vendors supporting the “as-built” system. The courses will transition to SFOC personnel when expedient.

CLCS users, including system operators, console users and set support personnel, require orientation and usage training during a time frame prior to milestone delivery at their work sites.

Full time instructors will be supported byDIs from the user community as needed to provide on-time delivery of training.

For the user community, classroom training will be presented to provide:

- CLCS operational environment familiarization, supporting developers and users of the early milestone deliveries.
- Recurring requirement and follow-on training to support subsequent delivery cycles.

Hands on training during the initial deployment stages will occur mainly on the job as a result of participation in application software test, verification, and simulation runs. From development stage testing through integration and operational test phases, engineers will gain familiarity with the new CLCS applications implemented to eventually support operational testing of hardware systems. The development and formalization of this training will be done by the requester(s) and developer(s) in conjunction with SFOC technical training instructors.

As the system matures and its design and usage stabilizes, hands-on training will be standardized as on-the-job training packages and documented courses.

4.2.2.1 Console Users

Simulations will play a key role in CLCS console user training. They will be made available to individuals at a ‘desk top’ level as well as in formal, integrated, simulation runs.

Formal simulations will provide the user with hands-on experience with the CLCS system by doing integrated, multi-console processing. These include:

- S0044 Countdown
- S0056 Tanking
- S0066 Hyperload

Simulation runs will provide benefits comparable to those obtained in software test and verification. Participation in simulation will exercise both the newly implemented application and its system engineer’s familiarity with its use. Handling of anomalies inherent in a simulation run exercise will broaden the engineer’s range of experience with the software and the new CLCS operational environment. Participation in ‘simulation runs’ will increase user competence in new applications software as well as increase user level of expertise in working with the new CLCS operational environment.

4.2.2.2 Sustaining Engineer Users

Most training for the CLCS sustaining engineers will occur on-the-job and be supplemented by classroom training.

Initial training for sustaining engineers will occur when, as developers, they receive training to accomplish their responsibilities. Subsequent and additional sustaining engineer training will be provided via courses identified during CLCS development as having recurring training

requirements. These will transition to the CLCS training team and DIs from among the engineering work force.

As new hardware and other updates occur during CLCS sustaining engineering, CLCS will acquire vendor supplied training to familiarize an initial set of employees with these items. DIs or technical trainers will acquire this information, when appropriate, and train additional personnel. CLCS training team participation in these training classes will depend on an evaluation of the most cost effective method of presenting follow-on training.

4.2.2.3 Operations and Maintenance Users

Training for the CLCS operations and maintenance personnel will include, but not be limited to, classroom training presented by the CLCS Training Team. Classroom training will be enhanced and supplemented by hands-on training

Classroom training will be provided to present new technology concepts and hardware component training. Vendor training will support users during early milestone deliveries. Recurring requirement and follow-on training supporting subsequent delivery cycles will be presented by CLCS Training Team members or DIs.

4.2.3 Sustaining Personnel

Training for sustaining personnel will be derived from those courses and OJT packages developed for the developers and users. As needed, new subjects will be added in response to changing technology and resources.

4.2.4 Course Groupings

Within the categories of trainees, individuals will be involved in various areas and disciplines. The developmental process will move these to a roughly cascading sequence. To accommodate this, and to facilitate identification of persons who have attained the requisites for their function, most courses will be grouped under the following headings:

- Real Time Control Application Software Orientation
- RTC Application Software Requirements Development and Testing
- RTC Application Software Development
- RTPS Orientation & Use
- SDC Orientation & Use
- Software Sustaining
- SDC Sustaining
- Operations Training
- COTS Maintenance & Sustaining Engineering
- VME Gateway Maintenance & Sustaining Engineering
- Networks Maintenance & Sustaining Engineering

The following lists the anticipated topics which will be included in the various course groupings.

Note: from grouping to grouping, the duration of a course covering a given topic will vary considerably.

4.2.4.1 Real Time Control Applications Software Orientation

- CLCS Orientation
- Introduction to Real Time Control Application Software Development
- RTC Application Software Architecture
- DOORS™ Overview
- SL-GMS™ Overview
- ControlShell™ Overview
- Razor™ Overview

4.2.4.2 RTC Application Software Requirements Development and Testing

- DOORS™ (detailed)
- SDE/IDE Familiarization (for validation testing

4.2.4.3 RTC Application Software Development

- SL-GMS™
- ControlShell™
- Visigenics CORBA
- Razor ™
- SDE/IDE Familiarization

4.2.4.4 RTPS Orientation & Use

CLCS Orientation
RTPS Orientation
Application Software Architecture
SL-GMS
ControlShell
CCP Familiarization
DDP Familiarization
CCWS Familiarization
Gateway Familiarization
CLCS Console Ops

4.2.4.5 SDC Orientation & Use

SDC Orientation
SDC Retrieval
SDC Advance Retrieval Products

4.2.4.6 Software Sustaining

CLCS Orientation

RTPS Orientation
Application Software Architecture
System Software
SL-GMS
ControlShell
CCP Familiarization
DDP Familiarization
CCWS Familiarization
Gateway Familiarization
Razor
COTS OS
COTS Network
COTS System Administration

4.2.4.7 SDC Sustaining

SDC Orientation
SDC Retrieval
SDC Advanced Retrieval Products
SDC Software

4.2.4.8 Operations Training

CLCS orientation
RTPS Orientation
Application Software Architecture
System Software Architecture
SL-GMS
ControlShell
CCP Familiarization
DDP Familiarization
CCWS Familiarization
Gateway Familiarization
CLCS Console Operation
CLCS System Operation
SDC Orientation
SDC Retrieval
Trouble Shooting
COTS OS
COTS Network
COTS System Administration

4.2.4.9 COTS Maintenance & Sustaining Engineering

CLCS orientation
RTPS Orientation
System Software Architecture
SL-GMS

ControlShell
CCP Familiarization/maintenance
DDP Familiarization/maintenance
CCWS Familiarization/maintenance
Gateway Familiarization/maintenance
SDC Familiarization/maintenance
Trouble Shooting
COTS OS
COTS Network
COTS System Administration
VME General
Network General
CLCS hardware Architecture

4.2.4.10 VME Gateway Maintenance & Sustaining Engineering

VME Bus
MVME Bus
PCM
Uplink
LDB
GSE
Others

4.2.4.11 Network Maintenance & Sustaining Engineering

TBD

4.3 CATEGORIES OF INSTRUCTION

Each basic type of instruction will be handled in terms of three general categories: generic, vendor specific, and CLCS unique. Generic courses and skills are those which are commonly used throughout the industrial community. An example of this would be UNIX operating system fundamentals. Vendor specific courses are those related to specific, off-the-shelf, devices purchased from vendors. The console workstations are an example of this category. CLCS unique courses, as the name implies, are those with information tailored to the CLCS.

Courses of a generic nature will be taken locally or remotely depending on circumstance. Sources will include the local universities and colleges, SFOC training, contracted trainers, Internet sources, and published materials. Especially with these courses, expediency will be a key factor in determining where and by whom a course will be conducted and attended.

Vendor courses will be presented, at least initially, by the respective vendors. These courses will include both hardware and software courses when the software is a proprietary item of the vendor. They will be held on site when student numbers and content justify doing so. For smaller numbers of personnel and when equipment is not available locally for a course, courses will be attended at the vendor training centers or other off-site locations. When student numbers and

recurrence of training justify doing so, either a representative of SFOC Training or a DI from among the students will be assigned to attend the vendor class with the intention of gaining the material and presenting it on site for future cycles of the class. This latter mode will also accommodate better tailoring of the course content to CLCS needs.

Because of the evolving environment and short turn around times, most CLCS unique courses will be standard classroom presentations, which may or may not have actual hands-on or simulation as part of the course. CLCS unique courses will be developed by SFOC instructors and subject matter experts from the user/developer community. Presentations will be done by either SFOC instructors or designated instructors of the user/developer community. As need and personnel availability changes, presentation assignments will be transferred between SFOC instructors and designated instructors.

The following tables contain a preliminary list of generic, vendor specific, and CLCS unique categories of instruction. The content of each list is subject to change based on product selections that will be finalized during CLCS development.

4.3.1 Generic Courses

Course	Description	Status
"C Programming," CG-223-LSC	Entry level course for software personnel working with the C language and a 'conversational' course for hardware personnel somewhat involved with the C language. (This is a prerequisite of the C++ classes)	USA Tech. Training 32 hr
C Programming, Adv.	This will be the follow on course of C language for software personnel.	Vendor 4 day
C++, Adv.	Fault tolerance, exceptions, libraries, reusability, templates, polymorphism, memory management, and new American National Standards Institute (ANSI) features.	Vendor 4 day
C++: "Intro to C++," CG-225-LSC	Basic I/O, inline functions, overloading, classes, objects, inheritance, and interface to C programs/functions	USA Tech Training 32 hr
Fast Ethernet, Adv.	Deployment, management, and trouble-shooting of 10 - 100MB Ethernet systems.	**V**endor 4 day
Hyper Text Mark-up Language (HTML)	Creating web pages using links, tables, images, format and general syntax. URL information on http, files, ftp, mailto and news information are presented.	TBD 4 hr
Java, Adv.	This course presents advanced features supported by Java to developers.	Vendor 3 day
Java, Fam.	This course introduces developers to using the Java language for implementing platform independent CLCS applications.	Vendor 2 day
LAN: "Introduction to Local Area Networking (LAN) Concepts and Hardware" EG-135-GTS	Local area networking terminology, major hardware, overall concepts, and an introduction to the ISO protocol model.	USA Tech. Training 3 hr

Course	Description	Status
LAN: Local Area Networking, Adv.	ISO model, problem awareness, frame structures, FDDI, and addressing directed to assisting troubleshooting.	Vendor 4 day
Object-oriented Analysis and Design, Adv.	Instruction on the software approach that views the solution to a problem in terms of the interaction among abstract entities called 'objects' instead of more traditional procedurally oriented interactions.	Vendor 5 day
Object-oriented Analysis and Design, Fam.	An introduction to object technology, definitions, and terminology from a user perspective.	Vendor 4 day
Oracle, Adv.	Presents how to create alter and delete database objects, and shows how to perform queries on a database using Oracle.	Vendor
Oracle, Fam.	Presents the basic concepts and features of Oracle including application development, distributive processing, and database administration.	Vendor
Relational Database Concepts	An introduction to relational databases presenting an approach to relational database design. Tables, queries, forms, reports, defining table relationships, and normalization are covered.	Vendor 4 day
SQL, Adv.	Advanced features of the Structured Query Language (SQL), which provides a user interface to relational database management systems. It is the standard.	Vendor
SQL, Fam.	An introduction to SQL, which provides a user interface to relational database management systems.	Vendor

Course	Description	Status
UNIX, Adv.	This will be the advanced course for people working the UNIX operating system	Vendor 4 day
UNIX Fam. CG-301-LSC	This course is for those people who will need some knowledge of the UNIX operating system.	USA Tech. Training 24 hr
"VME: A Basic Understanding" EL-147-GTS	An introduction to the basic theory and concepts of the Versa Module Eurocard (VME) standard and its components.	USA Tech. Training 3 hr
"VME: Beyond the Basics" (EL-247-GTS)	VMEbus features, specified signals, functional modules, system flow and relationships, signal priorities-grants-and-arbitrations, bus cycles, addressing, and the interrupt structure.	USA Tech. Training 4 hr
VRML, Adv.	Advanced features of the Virtual Reality Modeling Language (VRML), which is a draft specification for the design and implementation of a platform-independent language for virtual reality scene description.	Vendor
VRML, Fam.	An introduction to the VRML, which is a draft specification for the design and implementation of a platform-independent language for virtual reality scene description.	Vendor
X Motif, Adv.	Xlib and Xtoolkit	Vendor
X Motif, Fam.	Drawing area, labels, buttons, lists, scales, text, menus, and windows, dialogs (main, selection, custom), and scrolling widget types.	Vendor

4.3.2 Vendor Specific

Course	Description	Status
ControlShell, Adv.	Presents additional real-time data-flow, finite machine, and advanced features supported by the ControlShell environment in a hands-on manner for developers.	Vendor
ControlShell Concepts, Fam.	An in depth description of data-flow diagrams and finite state machines showing how ControlShell supports each concept.	Vendor
ControlShell, Orientation	An introduction to the terminology of data-flow diagrams and finite state machines supported by ControlShell.	Vendor 2 hr
CORBA by Visigenics	Detailed explanation and use of the CORBA Software Tool	Vendor ; In house; 5 days
DOORS Detailed	A tool to capture and define functional requirements and prepare validation test procedures	Vendor; In house; 2 days
DOORS Overview	A tool to capture and define functional requirements and prepare validation test procedures	Vendor; In house; ½ hr.
MVME2600/ 3600 Family Hardware	The Motorola MVME 2600 Single Board Computer currently intended to be the Central Processing Unit (CPU) used in all CLCS Gateways (Front End Processor (FEP) equivalents).	Vendor
Paradigm Plus	Introduction to Paradigm Plus for modeling domain objects, physical data bases, and business processes for software developers familiar with object technology terminology.	Vendor 8 hr
PCI System Architecture	Motorola PCI101: prerequisite of MVME2600/3600 Family Hardware, MVE104	Motorola
Razor - Configuration Management	Razor change tracking, file version, and release management for s/w developers.	Vendor

Course	Description	Status
Silicon Graphics Inc. (SGI) - Introduction to IRIX *	Introduces the native operating system for all SGI platforms, IRIX, which is similar to UNIX.	Vendor
SGI - Network Administration *	Networking fundamentals, configuration, trouble shooting, performance monitoring and other network operations	Vendor
SGI - Origin Server Maintenance *	Hardware overview, data flow and troubleshooting of the CPU along with the load and run of diagnostics.	Vendor
SGI - Parallel Programming *	Optimizing and tuning of programs (processes),multi-processes debugging, the what and how of parallel processes use of synchronization techniques and shared memory.	Vendor
SGI - Pro Dev *	SGI's Programming Development Environment	Vendor
SGI - Real-time Programming *	Real-time interfaces in C, inter-process communications, program performance analysis and system performance tuning.	Vendor
SGI - Systems Administration *	Training in system error monitoring, monitoring tools, multiprocessor CPU management, memory management, and the tuning of all system resources.	Vendor
SL-GMS, Fam.	Introduces developers and sustaining engineering personnel to how to use the Sherrill-Lubinski (SL) Graphical Modeling language.	Vendor 40 hr
"VME Trouble Shooting with a Bus Analyzer" EL-447-USA	Operation, features, and applications of the Silicon Control VME 210 Bus Analyzer, with lab exercises.	To be developed by USA Tech. Training
Wind River VxWorks Power PC Kernel (Tornado)	The VxWorks Power PC Kernel version 5.3 (Tornado): the current operating system used on the CPUs within the CLCS Gateways.	Vendor: Wind River

4.3.3 CLCS Unique Courses

Course	Description	Status
CLCS Console Operator	The user courses will be directed to those who will operate the CLCS consoles to perform vehicle and other application level tests.	In house
CLCS Orientation CL-100-USA	Describes in a general manner the overall structure and operation of the CLCS.	In house
CLCS System Level Maintenance	Intended for those who will do system level hardware maintenance on CLCS units.	In house
CLCS System Level Trouble Shooting	Information needed by CLCS system engineers to trouble shoot CLCS problems.	In house
CLCS System Operator	Directed to those people who will do the day to day operation and setup of the CLCS.	In house
Command and Control Processor (CCP), Adv.	Provides subsystem level theory of operation (using system analysis and troubleshooting tools) directed to those who will perform fault isolation and diagnosis of the CCP.	In house
Command and Control Processor (CCP), Fam.	Functional overview, connectivity, and data flow of the CCP.	In house
Data Distribution Processors (DDP), Adv.	Provides subsystem level theory of operation (with application of system analysis and troubleshooting tools) directed to those who perform DDP fault isolation and diagnosis.	In house
Data Distribution Processors (DDP), Fam.	A functional overview, connectivity, and data flow of the DDP.	In house
Gateways (each type), Adv.	Provides subsystem level theory of operation (with application of system analysis and troubleshooting tools) directed to those who will perform fault isolation and diagnosis of each type of Gateway subsystem.	In house
Gateways (each type), Fam.	Provides a functional overview, connectivity, and data flow of each gateway type.	In house

Course	Description	Status
Human Computer Interface (HCI), Adv.	Subsystem level theory of operation (with application of system analysis and troubleshooting tools) directed to those who will perform fault isolation and diagnosis of the HCI workstations.	In house
Human Computer Interface (HCI), Fam.	Functional overview, connectivity, and data flow of a HCI workstation.	In house
Gateways (each type), Adv.	Subsystem level theory of operation, with application of system analysis and troubleshooting tools, directed to those performing fault isolation and diagnosis of each Gateway subsystem type.	In house
Gateways (each type), Fam.	A functional overview showing connectivity and data flow for each gateway type.	In house
Intermediate/Depot Level Maintenance	These courses will be limited to those who do board level maintenance of CLCS units.	In house
IPT Methodology	The whys and hows of an integrated products team	In house; 1 hr.
RTC Application Architecture	The methodology of applying application software requirements to the RTC process	in house; (est. 3 hr.)
Real Time processing System (RTPS), Adv.	Interrelationship theory of RTPS system software and the COTS operating system within the RTPS subsystems, with application of system analysis and troubleshooting tools, for persons performing hardware/software fault detection and isolation within these subsystems (e.g., Gateways, CCP, DDP).	In house
Real Time Processing System (RTPS), Fam.	System level theory of RTPS operation, with application of system analysis and troubleshooting tools, for persons performing fault detection, isolation, and recovery of subsystems within the RTPS.	In house
RTPS, Orientation	System level overview of the RTPS.	In house

Course	Description	Status
Shuttle Data Center (SDC), Advanced Retrieval Products	Detailed description of SDC services and their utilization.	In house; (est: 8 hr.)
SDC Orientation	Overview of the SDC, its services, and how to utilize them.	In house (est: 4 hr)
SDC Retrieval	Description of SDC services and their utilization.	In house; (est: 4 hr.)
SDC Software	A description and discussion of the software utilized by the SDC.	In house; 3 days
SDE/IDE Familiarization for Validation Testing	The functionality of the Satellite Development Environment and the Integrated Development environment during validation testing.	In house; (est. 8 hr.)
SDE/IDE Familiarization	In-depth training into the methodologies and tools relating to the SDE/IDE environment	In house; (est. 3 days)
Simulation System (SIM), Orientation	Overview of SIM services and how to utilize them from CLCS consoles.	In house (est: 2 hr)

Course	Description	Status
SL-GMS User	Presents the SL-GMS graphical user interface display to console users.	In house (est:4 hr)
Satellite Development Environment (SDE), Orientation	SDE hardware and software configurations and the procedures controlling the use of SDE facilities.	In house (est: 1 hr) (Informal OJT?)
Sustaining Engineering	These courses will be directed to those who will do the modifications and enhancements design and remodeling of the CLCS.	In house
System Software Architecture, Orientation	This course is intended for those who will be performing real-time troubleshooting and sustaining engineering of the CLCS System Software.	In house (est: 2 hr)
VME: Beyond the Basics EL-247-GTS	Motorola VME101: Prerequisite for MVME2600/3600 Family Hardware,MVE104.	In house; 4 hr.

* Listings for Silicon Graphics Inc. (SGI) training are based on currentCLCS development platform. Platform selection is subject to change.

4.3.4 CCMS Crossover Courses

Depending on their job function, people new to launch processing system ortransitioning from one operational discipline to another will profit from taking certain of the existing CCMS courses. Though not listed here, the more likely course candidates of this type are included in the “CLCS Unique Courses” matrices in the appendix.

4.4 LEVELS OF INSTRUCTION

Course numbering and naming will be in accordance with the “SFOC Training/Certification Plan and Schedule Report” for the Space Flight Operations contract.

Courses will be designed to meet the CLCS related needs of specific employee categories. Information considered basic knowledge for the employees a course is intended to serve will be considered prerequisite for taking that course.

Subjects with overlapping application to various employee categories will have courses structured in a hierarchical manner to obtain maximum efficiency for trainees and instructors. The most elementary of these multilevel courses will be designated orientation courses. The more detailed, but still general audience courses will be designated familiarization courses. The most detailed courses will be designated to indicate their depth of content and/or the population they are intended to serve.

Appendix A Students Per Course Grouping By Quarter

The following matrix matches course groups to the expected number of students by fiscal year quarter to show the numbers of additional students who need that training during that quarter to support the CLCS project.

CLCS TRAINING COURSE GROUPINGS	FY'98				FY'99				FY'00				FY'01				Grouping Totals
	3/98Thor		9/98Atlas		3/99Titan		9/99Scout		3/00Delta		9/00Saturn		3/01Nova		9/01RLV		
	1998Q1	1998Q2	1998Q3	1998Q4	1999Q1	1999Q2	1999Q3	1999Q4	2000Q1	2000Q2	2000Q3	2000Q4	2001Q1	2001Q2	2001Q3	2001Q4	
Real Time Control Application Software Orientation		50															50
RTC Application Software Requirements Development and Testing			50														50
RTC Application Software Development				50													50
RTPS Orientation & Use							125	125	125	125							500
SDC Orientation & Use			100	100	100												300
Software Sustaining									15	20	15						50
SDC Sustaining				20													20
Operations Training						25	25	25	25								100
COTS Maintenance & Sustaining Engineering						10	10	10	10								40
VME Gateway & Sustaining Engineering						6		6		6							18
Network Maintenance & Sustaining Engineering								15									15
Column Totals		50	150	170	100	41	160	181	175	151	15						1193
Drop Totals	50		320		141		341		326		15						1193

Appendix B Groupings by Department Matrix

The following matrix matches course groups to the expected number of students per department by fiscal year quarter to show the numbers of additional students from each department who need that training during that quarter to support the CLCS project.

CLCS TRAINING COURSE GROUPINGS	DEPTS	FY'98				FY'99				FY'00				FY'01				GROUPING TOTALS
		3/98Thor		9/98Atlas		3/99Titan		9/99Scout		3/00Delta		9/00Saturn		3/01Nova		9/01RLV		
		1998Q1	1998Q2	1998Q3	1998Q4	1999Q1	1999Q2	1999Q3	1999Q4	2000Q1	2000Q2	2000Q3	2000Q4	2001Q1	2001Q2	2001Q3	2001Q4	
Real Time Control Application Software Orientation																		
(see 4.2.4.1 for topic list)	**DP5**		20															20
	52-21		20															20
	55-XX		10															10
	TOTAL		50															50
RTC Application Software Requirements Development and Testing																		
(see 4.2.4.2 for topic list)	**DP5**			20														20
	52-21			20														20
	55-XX			10														10
	TOTAL			50														50
RTC Application Software Development																		
(see 4.2.4.3 for topic list)	**DP5**				20													20
	52-21				20													20
	55-XX				10													10
	TOTAL				50													50
RTPS Orientation & Use																		
(see 4.2.4.4 for topic list)	**55-XX**							84	84	84	84							336
	NASA							28	28	28	28							112
	B&A							7	7	7	7							28
	Rocketdyne							3	3	3	3							12
	EG&G							3	3	3	3							12
	TOTAL							125	125	125	125							500
SDC Orientation & Use																		
(see 4.2.4.5 for topic list)	**55-XX**			75	75	75												225
	NASA			20	20	20												60

	52-21 GLS			1	2	2												5
	B&A			2	1	2												5
	Rocketdyne			2	2	1												5
	TOTAL			100	100	100												300
Software Sustaining																		
(see 4.2.4.6 for topic list)	**52-22**									15	15	15						45
	Others										5							5
	TOTAL									15	20	15						50
SDC Sustaining																		
(see 4.2.4.7 for topic list)	**52-22**				18													18
	Others				2													2
	TOTAL				20													20
Operations Training																		
(see 4.2.4.8 for topic list)	**52-11**						10	10	10	10								40
	52-13						15	15	15	15								60
	Others																	
	TOTAL						25	25	25	25								100
COTS Maintenance & Sustaining Engineering																		
(see 4.2.4.9 for topic list)	**52-11**						3	3	3	3								12
	52-12						1	1	1	1								4
	52-15						4	4	4	4								16
	52-24						2	2	2	2								8
	TOTAL						10	10	10	10								40

VME Gateway Maintenance & Sustaining Engineering																		
(see 4.2.4.10 for topic list)	**52-11**						2		2		1							5
	52-12						1		2		1							4
	52-15						2		2		3							7
	52-24						1				1							2
	TOTAL						6		6		6							18
Network Maintenance & Sustaining Engineering																		
(see 4.2.4.11 for topic list)	**52-11**								4									4
	52-12								2									2
	52-13								2									2
	52-15								4									4
	52-24								3									3
	TOTAL								15									15
GRAND TOTALS			50	150	170	100	41	160	181	175	151	15						1193

Appendix C Course Grouping Presentations x Hours Per Grouping

The following chart summarizes for each course grouping the total number of CLCS students to be attending that grouping, the number of students per grouping presentation, the number of groupings to be offered and the estimated number of training hours per grouping.

CLCS TRAINING COURSE GROUPINGS	Number of Students	# of Students Per Grouping	# of Groupings to be Offered	Esimated Hrs. Per Grouping	TOTAL HOURS
Real Time Control Application Software Orientation *	50	25	2	12	24
RTC Application Software Requirements Development & Testing*	50	13	4	20	80
RTC Application Software Development **	50	13	4	40	160
RTPS Orientation & Use	500	42	12	45	540
SDC Orientation & Use ***	300	25	12	16	192
Software Sustaining	50	17	3	80	240
SDC Sustaining	20	10	2	40	80
Operations Training	100	13	8	89	712
COTS Maintenance & Sustaining Engineering	40	10	4	83	332
VME Gateway & Sustaining Engineering	18	6	3	80	240
Network Maintenance & Sustaining Engineering	15	15	1	40	40
COLUMN TOTALS	1193		55		2640

* Lecture class

** Hands-on class

*** Lecture class with hands-on homework

Appendix D Projected Schedule of CLCS Course Groupings

This chart shows the projected delivery of CLCS related instruction course groupings.

CLCS TRAINING COURSE GROUPINGS	FY'98				FY'99				FY'00				FY'01			
	3/98Thor		9/98Atlas		3/99Titan		9/99Scout		3/00Delta		9/00Saturn		3/01Nova		9/01RLV	
	1998Q1	1998Q2	1998Q3	1998Q4	1999Q1	1999Q2	1999Q3	1999Q4	2000Q1	2000Q2	2000Q3	2000Q4	2001Q1	2001Q2	2001Q3	2001Q4
Real Time Control Application Software Orientation *		2 classes														
RTC Application Software Requirements Development & Testing*			4 classes													
RTC Application Software Development **				4 classes												
RTPS Orientation & Use							3 classes	3 classes	3 classes	3 classes						
SDC Orientation & Use***			4 classes	4 classes	4 classes											
Software Sustaining									1 classes	1 classes	1 classes					
SDC Sustaining					2 classes											
Operations Training						2 classes	2 classes	2 classes	2 classes							
COTS Maintenance & Sustaining Engineering						1 class	1 class	1 class	1 class							
VME Gateway & Sustaining Engineering						1 class		1 class		1 class						
Network Maintenance & Sustaining Engineering								1 class								

* Lecture class
** Hands-on class
*** Lecture class with hands-on homework

NOTE: 1) "class" = one course grouping presentation
2) Schedule is an initial CLCS training delivery plan
3) Schedule will use vendor, third-party, DI and USA Technical Training instructors

KEY
Critical task
Planned duration
Task Progress

Appendix E Glossary and Acronyms

Adv.	Advanced
ANSI	American National Standards Institute
ATM	Asynchronous Transfer Mode
CCMS	Checkout, Control, and Monitor Subsystem: that portion of the present LPS which is directly related to the processing of specific vehicle and ground support equipment systems.
CCP	Command and Control Processor
CCS	Complex Control Set
CITE	Cargo Integration and Test Equipment
CLCS	Checkout and Launch Control System: the replacement Launch Processing System.
Console User	A system engineer whose primary role is to write requirements, verify software, and conduct vehicle checkout and launch.
ControlShell	A software composition environment for developing complex, real-time applications
COTS	Commercial off-the-Shelf
CTT	CLCS Training Team
Developers	For the most part, members of the Applications Software department who will become the sustaining software personnel after the CLCS development phases.
DFRC	Dryden Flight Research Center
DI	Designated Instructor
DDP	Data Distribution Processor
DRD	Data Requirements Description
EPD	Electrical Power Distribution

Fam.	Familiarization
FEP	Front End Processor
FR	Firing Room
Gantt	A chart designed to depict planned actions along with actual progress.
GN&C	Guidance, Navigation, and Control
GSE	Ground Support Equipment
HCI	Human Computer Interface
HMF	Hypergolic Maintenance Facility
HTML	Hypertext Markup Language
IDE	Integrated Development Environment
IPT	Integrated Product Team
IRIX	The SGI operating system
ISO	International Standards Organization
Java	A program language designed for communications specific to the Internet.
Juno	3/97 CLCS Major Delivery
KSC	Kennedy Space Center
LPS	Launch Processing System
LAN	Local Area Network
LDB	Launch Data Bus
LH2	Liquid Hydrogen
LOX	Liquid Oxygen
NASA	National Aeronautics and Space Administration
NLPS	New Launch Processing System
OCR	Operations Control Room (formerly Firing Room and Control

	Room)
OJT	On-the-Job Training
OPF	Orbiter Processing Facility
Oracle	A sophisticated, high-end, database system
PPCO	Program Provisioning Change Order
Redstone	9/97 CLCS Major Delivery
RLV	Reusable Launch Vehicle
RTC	Reat Time Control
RTPS	Real Time Processing System
S/W	Software
SAIL	Shuttle Avionics Integration Laboratory
SDC	Shuttle Data Center
SDE	Satellite Development Environment
SFOC	Space Flight Operations Contract
SL-GMS	Sherrill-Lubinski Graphical Modeling System
SLWT	Super Light Weight Tank
SGI	Silicon Graphics Inc.
SPI	Standard Practice Instruction
SQL	Structured Query language
STS	Space Transportation System
TCRS	Training Certification and Records System
Thor	3/98 CLCS Major Delivery
UNIX	Operating system by AT&T
URL	Universal Resource Locator
USA	United Space Alliance

VME or **V.M.E.** Versa Module Eurocard

VRML Virtual Reality Modeling Language